REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	10/05/78	

4. TITLE AND SUBTITLE
STUDIES OF ENVIRONMENTAL FATES OF DIMP AND DCPD, MONTHLY PROGRESS REPORT 3

5. FUNDING NUMBERS
DAMD 17 78 C 8053

6. AUTHOR(S)
SPANGGORD, R.; CHOU, T.; MABEY, W.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
SRI INTERNATIONAL
MENLO PARK, CA

8. PERFORMING ORGANIZATION REPORT NUMBER
81340R08

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
ARMY MEDICAL RESEARCH AND DEVELOPMENT COMMAND
FORT DETRICK, FREDERICK, MD

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

THE OBJECTIVES OF THIS RESEARCH ARE TO CONDUCT LABORATORY EXPERIMENTS THAT WILL PREDICT THE PHOTOCHEMICAL AND BIOLOGICAL TRANSFORMATIONS OF DCPD AND DIMP IN THE SOILS AND WATERS OF ROCKY MOUNTAIN ARSENAL AND WILL PROVIDE A SEMIQUANTITATIVE EVALUATION OF DECOMPOSITION RATES OF AND PRODUCTS RESULTING FROM DCPD AND DIMP. DURING SEPTEMBER, 14 C-LABELED DCPD AND DIMP WERE RECEIVED, OXIDATION PRODUCTS OF DCPD WERE INVESTIGATED, THE MOLAR ABSORPTIVITIES OF DCPD AND DIMP WERE MEASURED, AND WORK CONTINUED TOWARD THE DEVELOPMENT OF ACCLIMATED CULTURES IN THE BIOTRANSFORMATION OF DCPD AND DIMP.

14. SUBJECT TERMS
CONTAMINANTS, FAUNA, FLORA, SOIL, GROUNDWATER, CHEMICALS, BIODEGRADATION

15. NUMBER OF PAGES

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED			

ORIGINAL

81340R08

SRI International

STUDIES OF ENVIRONMENTAL FATES OF DIMP AND DCPD

Monthly Progress Report 3

5 October 1978

By:

Ronald J. Spanggord, Ph.D.
Tsong-Wen Chou, Ph.D.
William R. Mabey, Ph.D.

Prepared for:

Commander
U.S. ARMY MEDICAL RESEARCH AND DEVELOPMENT COMMAND
ATTN: SGRD-UBG
Fort Detrick
Frederick, Maryland 21701

Contract No. DAMD 17-78-C-8053
William Dennis, Project Officer

SRI Project LSU-7551

Accesion For	
NTIS CRA&I	X
DTIC TAB	☐
Unannounced	☐
Justification	
By	
Distribution /	
Availability Codes	
Dist	Avail and / or Special
A-1	

Approved by:

Peter Lim 12/22

Peter Lim, Director
Pharmaceutical Analysis Laboratory

W. A. Skinner

W. A. Skinner, Executive Director
Life Sciences Division

SRI International

333 Ravenswood Ave. • Menlo Park, California 94025
(415) 326-6200 • Cable: STANRES, Menlo Park • TWX: 910-373-1246

INTRODUCTION

The U.S. Army Medical Bioengineering Research and Development Laboratory has the responsibility of developing environmental standards for pollutants that contaminate the environment at Army installations. Two such pollutants at the Rocky Mountain Arsenal are dicyclopentadiene (DCPD) and diisopropylmethylphosphonate (DIMP).

The objectives of this research are to conduct laboratory experiments that will predict the photochemical and biological transformations of DCPD and DIMP in the soils and waters of Rocky Mountain Arsenal and will provide a semiquantitative evaluation of decomposition rates of and products resulting from DCPD and DIMP.

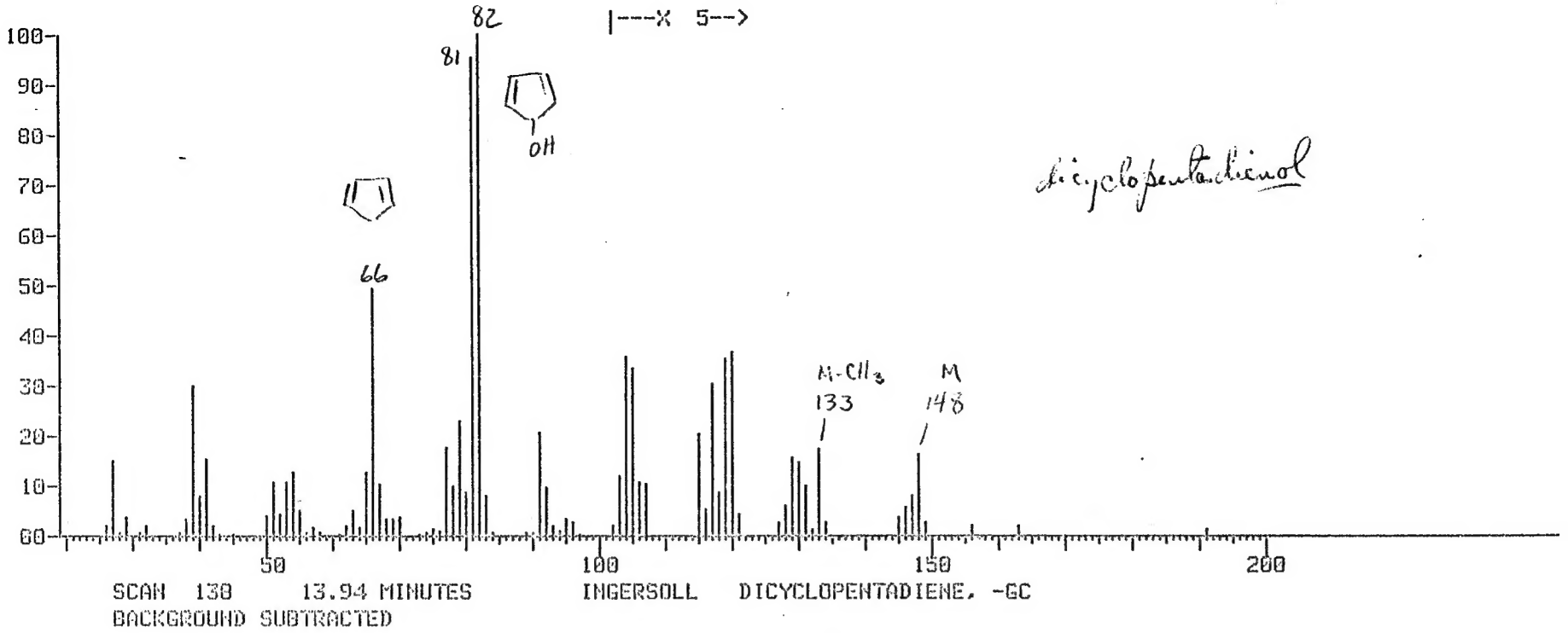
PROGRESS

During September, ^{14}C-labeled DCPD and DIMP were received, oxidation products of DCPD were investigated, the molar absorptivities of DCPD and DIMP were measured, and work continued toward the development of acclimated cultures in the biotransformation of DCPD and DIMP.

Analytical Chemistry

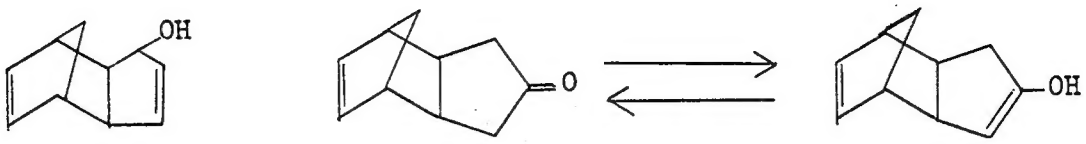
^{14}C-Labeled DCPD and DIMP (5 mCi each) were received from KOR Isotopes and will be used in soil biotransformation studies next month.

Distilled samples of DCPD (colorless, 98% purity by gc) developed a yellow hue only on the surface when stored in stoppered flasks under refrigeration; this indicates that chemical oxidation may play an important role in the environmental fate of DCPD. Gas chromatography profiles of this material are beginning to resemble the profile presented in Monthly Report No. 1 (page 5), with the major transformation product being represented by mass spectral scan 138, as shown in Figure 1. Mass spectral evidence indicates that the product may be represented by structure I formed by the allylic oxidation of DCPD; however, structures IIa and b must also be considered.



dicyclopentadienol

FIGURE 1 PROFILE OF DCPD OXIDATION PRODUCT



I IIa IIb

Mass spectral evidence indicates that the bridgehead carbon in the unknown product is intact.

This oxidative process has not been observed in biological or photochemical studies as yet; however, concentration levels may be too low to permit observation of this competitive process.

Biodegradation

DIMP-biodegrading microbes were obtained from the North Bog at RMA. For 5 weeks, they have been acclimating in aerated 9-liter bottles, static 4-liter bottles, and in a static 2-liter bottle at 10° C. No DIMP biodegradation has been indicated. Also, no DIMP degradation has been observed with periodic transfers of the microbes into shaker flasks with media and either DIMP and tris buffer or DIMP and tris buffer plus glucose, glycerol, or succinate as added carbon sources.

The microbes grew in medium containing tris buffer, glucose, and methyl phosphonate as the sole phosphate sources. This indicates that isopropylmethylphosphonate (IMP) may serve as a possible cosubstrate for DIMP degradation. We will test this possibility when we receive IMP.

Isopropanol was added to the 9-liter bottle sample, and the growth of microorganisms was sustained; however, the growth rate was slower than that in glucose medium. No DIMP was observed to biodegrade in this system with isopropanol as a cosubstrate.

DCPD-biodegrading organisms obtained from the North Bog at RMA are being acclimated. Because DCPD from water is highly volatile, DCPD is added periodically and its disappearance is monitored by comparison with a sterile control. Shaker flasks containing DCPD or DCPD plus glucose and yeast extract have been transferred twice a week. After 5 weeks, no acclimation of DCPD-biodegrading organisms has been obtained.

Similar acclimation studies with DCPD in RMA soils are in progress. No acclimated cultures have been obtained as yet. Cosubstrates, such as naphthalene, cyclohexane, and methylbutane, have not aided in the production of DCPD-degrading organisms.

Attempts have been initiated to obtain DIMP- and DCPD-biodegrading organisms from the Palo Alto Sewage plant, Palo Alto, California.

Photochemistry

The photochemical studies on DCPD have continued to be complicated by volatilization of DCPD from solution. Although the special Teflon® caps have alleviated the problem of volatilization losses during photolysis and sampling for glpc analysis, a problem still remains in preparation and transfer of the DCPD solutions into photolysis tubes. This problem is being corrected by construction of a special delivery system similar to one previously used in other studies where such volatilization problems occurred.

The uv-visible molar absorptivities for DCPD and DIMP have been measured in the solar spectral region and are as follows:

λ	ε in $M^{-1}cm^{-1}$	
	DCPD	DIMP
280	9.7	.33
300	6.3	.22
340	1.6	.16
380	.25	.11
420	.08	.10
460	.03	.08
500	.02	.08

The molar absorptivity for DCPD in the wavelength region 280 nm to 360 nm has proven very difficult to measure reproducibly; a statistical analysis of the data is currently under way.

FUTURE WORK

The acclimation of DCPD and DIMP microbes will continue in both RMA samples and local sewage sludge. Also, preliminary tests for soil degradation of labeled DCPD and DIMP will be initiated. Photochemical studies with DCPD should be completed within the next month.

Exhibit A is the performance schedule for project tasks, and Exhibit B is a graphic representation of expenditures to date.

EXHIBIT A PERFORMANCE SCHEDULE FOR PROJECT TASKS

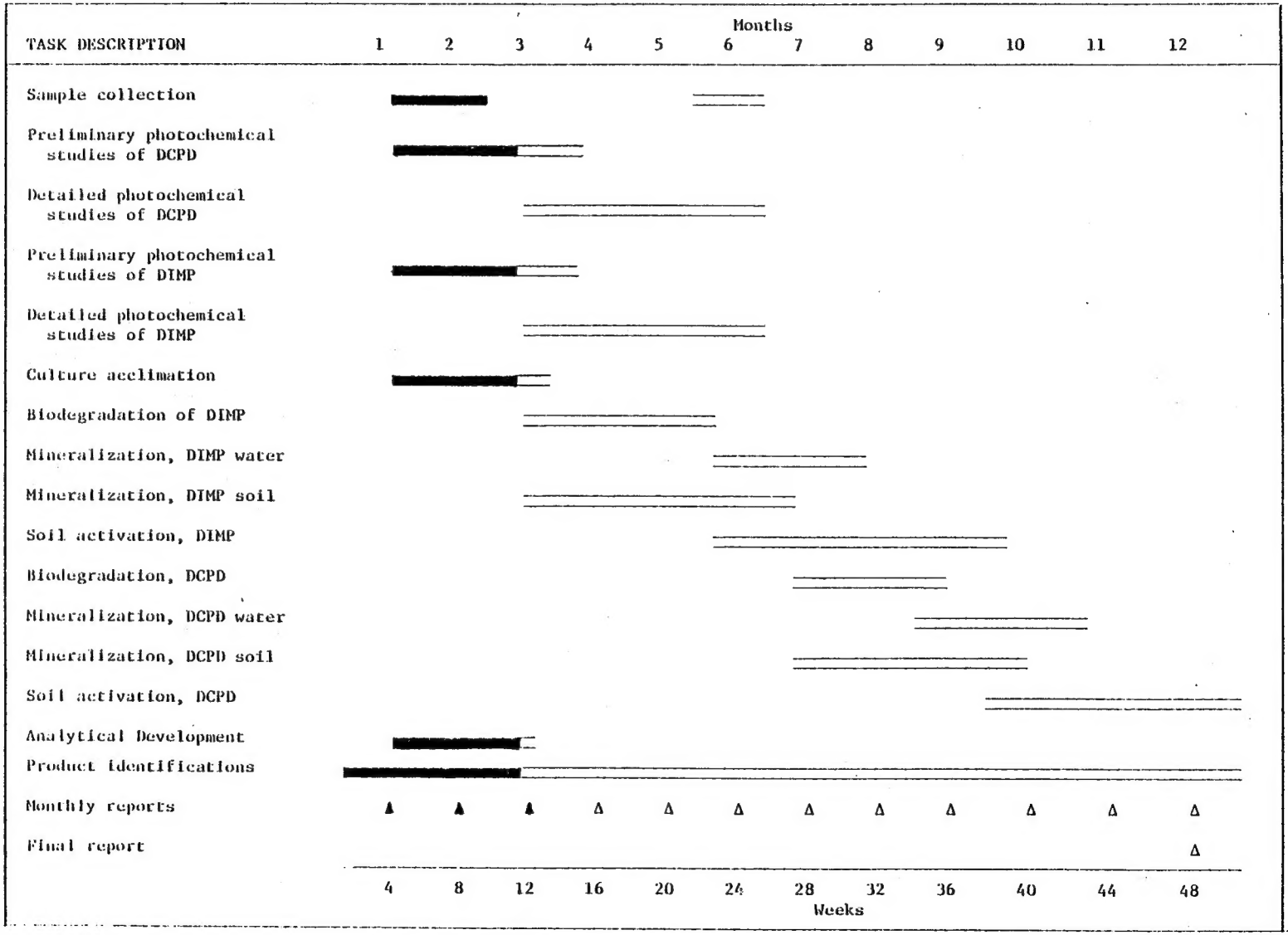


EXHIBIT B EXPENDITURES